Plant Ecology, Examination 1
October 3, 2000 Name _____

Please restrict your response to the space available. Answer directly and fully - don't beat around the bush. The point values for each question are given in parentheses. Your notes added to the Winthrop's PDF printout may be helpful in answering the exam. All page references refer to Winthrop Weatherby's notebook.

1 (12). What kind of ecosystem occurs at **location 7226**? Justify your answer based on the climate diagram (page 66) and the life form data (page 63).

6 points. Location 7226 is a grassland ecosystem.

6 points. We know this because the climate diagram illustrates all of the key characteristics of the climate in grassland ecosystems:

a) **precipitation is very close to the monthly potential evapotranspiration**
b) **winter temperatures are cool to cold (near 0 °C), but not as cold as in tundra regions**
c) **summer temperatures ar warm (15-25 °C).**

2 (12). Where is **location 7228**? What kind of ecosystem would you expect to find in **location 7228**? Justify your answers based on the climate diagram (page 66) and the life form data (page 63).

6 points. Given the travel restrictions, location 7228 is in one of two possible geographic regions: the southwestern portions of North America (probably Arizona or northern Mexico) or in southeastern South America (maybe the Patagonia region of Argentina).

6 points. Location 7228 is a warm desert ecosystem. We know this because

a) **precipitation is always less than potential evapotranspiration**
b) **the predominant life form is an annual, indicating high year-to-year variability in precipitation, which is another characteristic of desert regions**

3 (12). Where is **location 1937** located geographically and what kind of ecosystem should occur here? Justify your answer.

6 points. Location 1937 is a tundra ecosystem.

6 points. We know this because the climate diagram illustrates all of the key characteristics of the climate in tundra ecosystems:

a) **precipitation is low and very close to the monthly potential evapotranspiration**
b) **winter temperatures are very cold; the summer period of above 0 °C is short**
c) **summer temperatures ar cool (0 - 10 °C).**

4 (9). Regarding measured *Albi seeyna* and *Albi darnd* leaf temperatures on page 65, why are these values so similar between the leaves of the two species given the observed large differences in leaf absorptance?

The leaf temperatures of the two species are so similar because both species have mechanisms to reduce leaf temperature *Albi seeyna* leaves have a high transpirational cooling to offset the high energy absorptance and maintain a temperature 3 °C below air temperature. *Albi darnd* leaves have lower transpirational cooling, but maintain their low temperatures by greatly reducing the solar energy absorbed by the leaf. These contrasts are seen by comparing the relative differences in the leaf conductances and i the leaf absorptances.

5 (15). Some of Winthrop's notes that you have not seen hint that **location 2207** may have had a dense forest. Do you believe this is correct? What kind of ecosystem would we expect to find at location 2207? Where in North and/or South America would you expect to find this environment? Justify your answers.

5 points. Yes, location 2207 is likely to have dense forests.

5 points. The climate diagram for location 2207 is similar to that expected for deciduous forest ecosystems. We know this because the climate diagram illustrates all of the key characteristics of the climate in deciduous forest ecosystems:

- **a) precipitation is high and exceeds the monthly potential evapotranspiration**
- **b) winter temperatures are cool to cold**
- **c) summer temperatures ar warm (15-25 °C).**

5 points. I would expect to find the deciduous forest ecosystems in regions of both North America and South America wherever precipitation greatly exceeded potential transpiration an summertime temperatures are warm. This would include most of the southeastern United States (e.g., Virginia, North Carolina, South Carolina) and southeastern South America (e.g,. northern Argentina, Paraguay, southern Brazil).

6 (15). What kind of ecosystem would occur in **location 7227**? Provide a reasonable explanation based on lecture materials for why the life-form diversity is so high at this site (referred to on pages 63 and 67).

6 points. We would expect to find a desert ecosystem in this region. We know this because the climate diagram illustrates all of the key characteristics of the climate in desert ecosystems:

- **a) precipitation is less than the monthly potential evapotranspiration; precipitation is biseasonal**
- **b) winter temperatures are cool to warm**
- **c) summer temperatures are hot (15 - 30 °C).**

9 points. The life form diversity is probably high because different sets of species have adapted to be active during (a) the winter rain period, (b) the summer rain period, or (c) during both rain periods. By specializing for a particular set of climatic conditions, it is possible for more species with specific sets of adaptations to persist in this variable environment.

7 (15). What is the basis for the observed plant distributions on north-facing and south-facing slopes near **location 7258** as described on page 64.

The likely basis for the differences in vegetation on the two slopes has to do with the solar energy heating differences. The south-facing slopes have a much higher solar energy load, resulting in a microclimate that is much warmer. As a result, the soils dry out faster in both winter and in summer. This results in an environment more favorable to grasses than to shrubs.

8 (10). Briefly describe why the daytime microclimate profile of air temperature at **location 2207** (page 69) is warmest near the ground and cooler at greater heights.

The air temperature profile over bare ground during the day is warmest nearest the ground, because the bulk of the solar energy is absorbed by the soil surface and converted to heat. In turn, convective processes carry this heat away from the surface through small turbulent exchanges. The result is that the warmest packets of air are near the surface. This profile can only be maintained as long as there is a high energy load received by the bare ground surface.